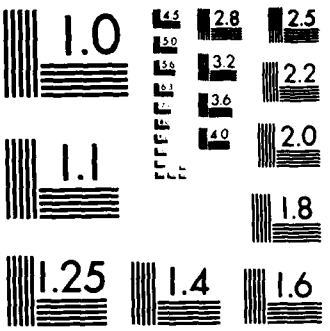
AD-A174 910 SYSTEM FOR INVESTIGATING SUPERCONDUCTING FILMS WITH SURFACE ACOUSTIC WAVE (U) WISCONSIN UNIV-MILWAUKEE DEPT OF PHYSICS M LEVY 14 JUL 85 AFOSR-TR-86-2091 1/1

UNCLASSIFIED AFOSR-84-0221 F/G 20/12 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

(2)

AD-A174 910

DTIC FILE COPY

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: AFOSR-TR- 86-2091

2. GOVT ACCESSION NO.

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)

System for Investigating Superconducting Films with Surface Acoustic Waves Down to 4.5 Millikelvin and Up to 4 GHz

5. TYPE OF REPORT & PERIOD COVERED

Final Scientific Report
July 15, 1984 to July 14, 1985

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)

Moises Levy

8. CONTRACT OR GRANT NUMBER(s)

AFOSR-84-0221

9. PERFORMING ORGANIZATION NAME AND ADDRESS

University of Wisconsin-Milwaukee
Department of Physics
Milwaukee, WI 53201

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

61102F 2917/A3

11. CONTROLLING OFFICE NAME AND ADDRESS

Air Force Office of Scientific Research / NE
Bolling AFG Building 410
Washington, D. C. 20332

12. REPORT DATE

13. NUMBER OF PAGES

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

Same as 11

15. SECURITY CLASS. (of this report)

UNCLASSIFIED

15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Approved for public release;
distribution unlimited.

DTIC ELECTE DEC 9 1986 S A B

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

superconducting films	Dilution refrigerator
surface acoustic waves	superconducting magnet
4.3 millikelvin	frequency agile attenuation measurement system
4 GHz	frequency agile velocity measurement system
95 K Gauss	submicron photolithography

(over)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A system for investigating superconducting films with surface acoustic waves down to 4.3 millikelvin up to frequencies of 4 GHz and up to magnetic fields of 95 K Gauss has been ordered, received and assembled. A dilution refrigerator has been installed in a new laboratory. It has been tested in place down to 4.3 millikelvin. The refrigerator has a top loading probe with four interchangeable slugs which can be used for different millikelvin temperature experiments. Each slug has 13 electrical leads which can be

(over)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

19. Key Words - continued
0.3 μm
interdigital electrodes
transducers
helium lambda tip

20. Abstract - continued

connected at millikelvin temperatures. A superconducting magnet has been obtained which has been tested up to 95 K Gauss in conjunction with a helium lambda tip. All the parts for an automatic ultrasonic attenuation and velocity system in the frequency range of 10 MHz to 4000 MHz have been ordered and assembled. Parts for the submicron photolithography subsystem required to reproduce masks with linewidths of 0.3 μ which will be used for making interdigital electrodes which will act as transducers to launch surface acoustic waves in the GHz range have been received and assembled.

RESEARCH OBJECTIVES AND APPROACHES

The objective of this DoD-URIP effort is to install a research system for investigating superconducting films with surface acoustic waves down to temperatures of 4.5 millikelvin, up to frequencies of 4 GHz and up to magnetic fields of 90 K Gauss. A dilution refrigerator would be used for obtaining temperatures in the millikelvin range. A superconducting magnet would be used for attaining the magnetic fields. A frequency agile attenuation and velocity measurement system which covers the frequency range from 10 to 4,000 MHz will be assembled for producing and detecting the electromagnetic signals required to make the measurements. And, a submicron photolithography system would be acquired that would permit contact reproduction of masks with line widths of 0.3 μ. This photolithography system is required for producing the interdigital electrodes that are used as transducers for producing surface acoustic waves in the GHz frequency range.

ACCOMPLISHMENTS

A dilution refrigerator has been purchased from Oxford Instruments. It has been installed in a new laboratory in the basement of the Physics Building. A pit nine feet deep by 2-1/2 feet wide by 10 feet long has been excavated and finished to house the dewar. A housing has been installed in a room above the laboratory to permit a probe to change samples and experiments while the dilution refrigerator is operating at millikelvin temperatures. The installation of the dilution refrigerator required having 26 clear feet of vertical space. The dilution refrigerator has been tested and it achieved a temperature of 4.3 millikelvin. The top loading probe was satisfactorily tested. Four slugs and a housing for performing different millikelvin experiments have been machined at UWM. Each slug has 13 independent electrical connections which can be engaged to the housing at low temperatures.

A superconducting magnet was obtained from Oxford Instruments, which together with a helium lambda tip was tested up to fields of 95 K Gauss.

A Hewlett Packard computer has been obtained which will run the ultrasonic measuring equipment and monitor the dilution refrigerator.

All the parts required to assemble and build the automatic ultrasonic attenuation and velocity measurement system have been purchased and delivered. The system has been assembled on a breadboard and satisfactorily tested. It is now being installed into its permanent configuration.

The flowbooth, illuminator and millipore water treatment system for the submicron photolithography sybsystem have been ordered and, delivered. They are presently being installed and tested.

TECHNICAL PERSONNEL

In addition to the principal investigator, the following technical personnel have worked on this grant. All these personnel have been university supported when they worked on this grant.

Faculty

Dr. Bimal Sarma	(Assistant Professor) Dilution refrigerator

Postdoctoral Fellow

Dr. Qiang Yong Jia	(Visiting Research Fellow) Dilution refrigerator

Graduate Students

Mr. Roy Wiegert	(Graduate Student) Automatic attenuation and velocity measuring system.
Mr. Anders Schenstrom	(Graduate Student) Computer specification and installation.

Technicians

Mr. John Jacobs	(Instrument Maker) Part-time on this project. Dilution refrigerator.
Mr. Michael Mitchell	(Machinist and Technician - Part time on this project. Dilution refrigerator, ultrasonic attenuation and velocity measuring system, submicron photolithography.

END

1-87

DTIC